

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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The Utility of Scientific Truth

IF a historian of a century hence were to be asked what was the predominant feature of the 20th century, it is doubtful whether he would give the reply that seems most obvious to us, namely, that it was characterised by the pugnacity of the human race. In the distant future historians will take a more balanced view than we are able to do to-day, and they will probably deduce that the feature of our times which most affected the future of mankind was the spirit of scientific inquiry known to us as Research. There are bodies, such as are represented by the Royal Society, the Physical Society, the Chemical Society and many others, to whom research means the discovery of the truth irrespective of the applications to which it may be put. Sir Henry Dale, in his Presidential Address to the Royal Society, defined the rights and duties of all these workers in pure science in a memorable sentence: "To seek the truth for its own sake in complete freedom from any kind of extraneous influence."

But this is not everything. Workers in pure science have in past years shown themselves to be in a state of acute anxiety lest, in this changing and perhaps materialistic world, no place should be found for pure research. For some reason which escapes us, pure scientists have for generations been able to get away with the conception that pure science is on a higher plane altogether than applied science. Sir Henry Dale, dealing with this anxiety lest academic research should be stifled, declared that "freedom and opportunity, rather than organisation, provides the conditions for the highest types of research." Other and greater pioneers of research have taken the same view; their discoveries have been due to individual genius, not to team work. Sir Henry is intensely concerned that science should not become linked up with politics lest its freedom be circumscribed and its impartiality destroyed. If pure research were controlled by political parties the danger that fundamental research might be neglected in order to deal with matters of immediate political interest would become real. Research of this character, however, is individualistic and the extent to which it becomes subservient to politics depends on the individual. It is unfortunate that most of those engaged in pure research are paid a salary to be teachers.

There is, however, a great mass of research—pure and applied—which is not "free from any kind of extraneous influence." Those engaged in pure science frown upon it from their self-elevated pedestal, but it is arguable that its direct and immediate influence on public welfare is greater than that of pure science. It is freely admitted that the one depends on the other; many of the great industrial developments of the world

have resulted from this co-operation. There are hundreds of laboratories all over the world where men and women work to order. An industrial problem arises and they are set to work to solve it. It may be that a use must be found for a troublesome by-product; or an established product is threatened by a new competitor so that it must be improved or put to new uses; or a method must be found of manufacturing cheaply a hitherto expensive chemical. Research of this type finds work for the unemployed, maintains the livelihood of millions, adds to the material well-being of the country or enables the poor to obtain medicines, foods and other things once available only to the rich. The industrial chemist is emphatically not the poor relation of those who undertake "the highest types of research."

Whether science should "become entangled in politics," to use Sir Henry's expression, depends on the meaning to be attached to the phrase. There are many great public questions to which there is a scientific answer. But what is scientifically correct may not always be politically desirable as an immediate policy. Only in totalitarian countries are people to be regimented against their will in times of peace. It is therefore necessary that controversy should be allowed before making changes. Political controversy may involve scientific argument and could conceivably call for scientific research. So long as scientists labour to discover the truth, and, once they do so, state it fearlessly without respect to political expediency, we should welcome the entanglement of science with politics. Most of the great schemes of social reform we look forward to after the war involve the application of applied science to social conditions. There is, nevertheless, a low form of industrial research which is devoted to finding why a particular product as it stands is better than a competing product—to provide talking points for the salesman, in short; and it would be a calamity if *this* type of research entered into politics.

Finally, Sir Henry urged the necessity of system as opposed to individualism if discovery is to be put to its full use. The uses to which a discovery is put may be social, and it is then for the Government to set up the system whereby it can be utilised. They may be medical, and then it is the medical profession that must organise the application. They may be industrial, and in those circumstances industry must develop the discovery. Application often lags and one of the problems that must concern us in the future is how the quicker application of a discovery can best be effected. The vast growth of the chemical industry in other countries in recent years has been due to the readiness with which the results of research have been exploited.

NOTES AND COMMENTS

Scrap Metal, Please!

OBSELETE plant and machinery are included in the list of items to which warlike purposes have given a new value—their value as scrap metal. It would be of real service if all factory owners would follow the advice given to publishers, printers, architects, and others, and make a thorough search of forgotten corners in their premises. In many instances it will be found that some old disused shed in a dusty backyard contains some item of cast-off machinery. No longer available to fulfil its original function, such machinery is now a priceless source of scrap metal for new munitions. Shipping space is far too valuable to-day for any of it to be devoted to the import of those cargoes of scrap metal to which this country has become accustomed; and a thorough exploration of our own resources in this line is therefore essential. Anyone who lives in a city that has suffered from air-raid damage will have noted the systematic sorting and collection of damaged metal that has been going on. Now it is for the lucky people who have escaped the air-raids to play their part and call the attention of the Salvage Department to such obsolete material as is available. The address to write to is: Lambeth Bridge House, London, S.E.1. Local authorities have been laggard in their response to the appeal for returns of available scrap, so the Ministry of Works and Buildings is taking the matter in hand itself, and Mr. J. C. Dawes, Deputy Controller of Salvage since the start of the war, has been appointed Controller of Salvage (Local Authorities). One other point that may concern industrial chemists: if you have recently conducted an advertising campaign you may have a stock of zincos, stereotypes, etc. Look them out and hand in the old ones; their metal is just as important to the salvage drive as is your out-of-date machinery.

Wholesale Prices in November

CONTINUING their upward trend, wholesale prices, as measured by the Board of Trade index number, showed a rise for November of 0.4 per cent. over October. Food prices rose by 0.7 per cent. and those of industrial materials and manufactures by 0.2 per cent., a similar increase to that of last month. The figure for the non-ferrous metals group again remained at 123.7 (1930 = 100); chemicals and oils rose from 128.5 in October to 129.2 in November; but the iron and steel group fell from 181.5 to 181.4. These figures represent an increase of 0.5 per cent. in the prices of chemicals and oils for the month and 5.6 per cent. on the whole year. The iron and steel group showed a decrease of 0.1 per cent. in November compared with the October figure. Certain chemicals and fertilisers were dearer, increases ranging from 1 to 6½ per cent. Among other industrial materials and manufacturers, the only group movement in excess of 0.5 per cent. was the increase of 0.7 per cent. shown by the cotton group, cloths being dearer by about 1 to 2½ per cent. As for the general position, the aggregate increase since the outbreak of war for the general index is 58 per cent., food prices have risen by 64 per cent., and industrial materials and manufactures by 55 per cent.

Chemist and Engineer in the Paint Industry

CO-OPERATION between chemist and engineer was the theme of last week's discussion arranged by the Oil and Colour Chemists' Association. Mr. G. W. Read-Baker, opening the discussion from the engineer's point of view, said that the chemist failed to take full advantage of the services the engineer had to offer him, at any rate in the paint industry, and many of his remarks would apply equally well to other branches of the chemical industry. It was a matter of vital importance to the success of the industry, he said, that there should be co-operation. In the reconstruction that must follow the war the paint manufacturer would be called upon for more and yet more production, and his machinery, flogged to death during the war to meet the needs of destruction, would be hard put to it to meet the demands of construction. Nothing short

of the very maximum of efficiency in the performance of his plant would be sufficient to satisfy those demands. He would rely first of all on his chemist for the preparation of his formulæ. His chemist must also analyse, criticise and apply thorough tests to the finished commodity in order to become thoroughly familiar with the product, both as regards its physical nature and the behaviour of the ingredients in his formulæ. It was that physical knowledge that would enable him to specify to the engineer exactly what he wanted. And it was also the benefit of that physical knowledge that the engineer required in order to be able to design the machinery needed for production. The combined study by chemist and engineer of what actually happened, both physically and chemically, whilst the ingredients were being mixed and ground was the keynote to successful paint making. He pleaded for a keener study by the chemist of the mechanics of manufacturing processes; the abolition of trial and error methods by elimination of variable factors; the adoption into formulæ of every measurable phenomenon during processing; and continued joint research by chemist and engineer into the behaviour of either new materials, new machinery, or both. A great deal of Mr. Read-Baker's opening speech, as well as of subsequent contributions to the discussion, naturally dealt with technical problems peculiar to the paint industry, but generally it was agreed that if chemists would formulate a series of practical research experiments on grinding, wetting, and similar processes, and would combine to produce results that would advance knowledge of the subject, they would be better able to explain their problems to the engineers. We feel that chemical engineers, in whatever section of the chemical industry they are concerned, will heartily concur. Free discussion of this kind within the industry cannot be too much encouraged.

Cornish Tin

AS a consequence of the latest developments of the war, considerable attention is being directed to the immediate future of tin mining in the Malay Peninsula and the prospects of the possible revival of the industry in Cornwall. Quite a number of Cornishmen have large interests in the mines in the Malay Peninsula which have for a long time produced substantial profits; in fact several of the most prosperous concerns there are known as the Redruth-Malaya Group. Naturally, little is known of the position in Malaya at the moment, but it is generally understood that the export of tin will be seriously affected. Whether the expected interference with tin mining in Malaya will be sufficient to encourage the revival of Cornish tin mining remains to be proved. The reopening and developing a tin mine is a slow and costly business and shortage of skilled miners will contribute to its difficulties involved. In any case, if there is a scarcity of tin in the country there is no doubt that Government authorities will take steps to see what can be done with the mines still working in Cornwall.

Chemical Matters in Parliament

Dyestuffs Control

IN the House of Commons last week, Captain Elliston asked the President of the Board of Trade what arrangements were made to ensure that adequate technical and scientific advice was available to the dyestuffs controller; and whether he would consider appointing an adviser with full technical and scientific abilities to assist him in his work.

Captain Waterhouse replied that the Dyestuffs Controller already had the assistance of an advisory committee and of two part-time technical advisers appointed respectively by the Association of British Chemical Manufacturers and the Colour Users' Association. It was therefore not considered that there was any need for the additional appointment suggested.

(Contents appears on p. 318.)

MOLECULAR DISTILLATION, I

Advances in a New Branch of Chemical Industry

by D. D. HOWAT, B.Sc., A.I.C., A.Inst.M.M., Ph.D.

CERTAIN types of long-chain hydrocarbon oils (Apiezon products) for use in condensation pumps and as vacuum oils and greases prepared by C. R. Burch¹ of Metropolitan Vickers Electrical Co., Ltd., represented the first commercial application of the process of molecular distillation. A symposium² was compiled by the Society of Chemical Industry in 1939 to which contributions were made by members of research staffs of Metropolitan Vickers Electrical Co., Ltd., the Bataafsche Petroleum Co., of The Hague, I.C.I. (Alkali), Ltd., and the British Drug Houses, Ltd. In the United States very important and far-reaching developments in this subject have been made by a team of experts under the direction of Dr. K. C. D. Hickman, of Distillation Products Inc., Rochester, N.Y. In presenting any account of this subject frequent reference must be made to the symposium mentioned above and to the extensive series of papers published by Dr. Hickman and his collaborators.

The invention by Langmuir³ in 1916 of the condensation pump giving pressures less than 10^{-3} mm. led to the development of a series of highly specialised commercial processes for which these high vacua were essential. The manufacture of thermionic valves (in wireless transmission), X-ray tubes (in cancer therapy), and discharge tubes for the production of high-speed electrons and protons (in experimental work on the atomic nucleus) are examples of certain applications of the condensation pump. Another application of these pumps resulted in the growth of molecular distillation as a commercial process. More widely developed in the U.S.A. than elsewhere this new process has been a means of producing very high grade vitamin concentrates and other specialised substances.

This distillation process is characterised by the use of permanent gas pressures so low (less than 10^{-3} mm.) that they play no essential part in determining the speed of distillation. Or another definition: distillation takes place in such high vacua that the space between the evaporating and condensing surfaces is substantially unobstructed space, while the distance between the two surfaces is preferably less than the mean free path of the residual gases present in the distillation chamber. (In actual practice the permissible distance may vary from $\frac{1}{2}$ inch to 6 inches).

Essentials of Molecular Distillation

Some essential points of difference between molecular distillation and ordinary methods of distillation may be briefly summarised as follows:

(a) Under ordinary conditions rapid evolution of vapour does not begin until the liquid boils, boiling point being, by definition, the temperature at which the vapour pressure of the liquid becomes equal to the vapour pressure of the atmosphere. The temperature at which free evolution of vapour takes place is therefore dependent on the superincumbent pressure. In molecular distillation this condition does not obtain. Provided the pressure is low enough to ensure that the majority of distillate molecules do not collide with the gas molecules in their passage from the evaporating to the condensing surfaces, further reduction in the pressure will not affect the rate of distillation.

(b) Under these low pressure conditions there is no well-defined temperature at which distillation begins, the rate of evaporation increasing rapidly with temperature. In the practice of molecular distillation the liquid is not allowed to boil, as splashing from the evaporating surface would cause contamination of the condensed material.

(c) When a liquid is boiling in an ordinary still, equilibrium exists between the liquid and the vapour at the temperature of distillation. In a molecular still, however, there is no effective coexistence of liquid and

vapour. If the pressure is sufficiently low collisions between pairs of distillate molecules will return only a negligible fraction to the evaporating surface, the majority passing directly across the still gap to the condenser under the pressure of the temperature gradient. The fractionating properties of a molecular still differ from those of the conventional type, becoming less the higher the speed of distillation.

Langmuir⁴ has shown that the ideal rate of evaporation may be expressed in the form:

$$N = 5.83 \times 10^{-2} p / \sqrt{(M/T)} \text{ gms/sec/cm}^2$$

where

p = vapour pressure

M = molecular weight

T = absolute temperature

Any discrepancy between the ideal rate of evaporation and the observed rate in molecular distillation will be caused by collisions between distilling molecules and foreign molecules or between individual distilling molecules, resulting in the return of evaporated molecules to the evaporator. Obviously then the molecular still must be so designed as to minimise the effect of collisions in the vapour phase. The pressure of permanent gases must be avoided, so that highly efficient pumps capable of exhausting easily and rapidly to very low pressure must be available. Further, the distance between the evaporating and condensing surfaces should not be greater than that of the mean free path of the distillate molecule. The practical limit of the degree to which this distance may be reduced is fixed by the difficulty in maintaining high vacua in narrow spaces and by the danger of contaminating the condensate by splashing. Fawcett stated in the symposium² that experimental evaporation rates were obtained of from 70 to 90 per cent. of the ideal rate.

Factors Controlling the Behaviour of Stills

Certain variable factors exercising a controlling influence in the behaviour of molecular stills may be discussed briefly at this point.

(a) *The Pressure in the Still.* In true molecular distillation where no equilibrium exists between vapour and liquid the rate of evaporation is proportional to the ratio between the vapour pressure at the temperature of distillation and the square root of the molecular weight. In any other type of distillation the rate of evaporation is proportional to the vapour pressure, the molecular mass effect vanishing. As indicated earlier, if the pressure is reduced below the point at which collisions between distillate and foreign gas molecules return only a negligible fraction of distillate to the evaporating surface, then any further reduction in pressure will produce no change in the rate of evaporation. If the pressure rises above this given value, the rate of evaporation falls off very seriously and the molecular mass effect disappears.

Assuming efficient technique in the assembly of the still, there are only two sources from which gas may be evolved with serious reduction in the vacuum: (1) gas or volatile vapour entering the still dissolved in the liquid; and (2) gas or volatile vapour formed in the still by decomposition at the temperature of distillation. The removal of gas from the liquid before it is fed to the still is effected by degassing when the liquid is subjected to decreasing pressures at gradually increasing temperatures. Fuller details of degassing equipment will be found in a later section. Distillation of the material will obviously not be carried out at a temperature high enough to cause decomposition, while traces of easily decomposable substances, e.g., certain impurities associated with free fatty acids in oils, should be removed by suitable pre-treatment.

The maintenance of the high vacua necessary is related not only to the capacity of the pumps, but also to the still design. Gases must be exhausted from the relatively constricted spaces between the evaporating and condensing

surfaces and through connecting pipes. At these very low pressures the mass of material transferred per unit of vapour volume is very small, so that pipes and ducts must be of large cross-section and as short as possible. For this reason the distance between the evaporating and condensing surfaces may not be made too small or the streaming resistance of the still system is increased. In certain circumstances the pressure in the still may be 100 times greater than the pressure actually produced by the pumps. The importance of connecting pipes of large cross-sectional area and short length must be emphasised.

(b) *The Thickness of the Film of Liquid on the Evaporator.* In a continuous molecular still of the falling-film type the rate of evaporation will be controlled by the rate of flow of the liquid over the evaporating surface, the thickness of the film, and the total area of evaporating surface. In the absence of ebullition in molecular distillation evaporation may only occur from the surface layers of the liquid. As the rate of evaporation is normally greater than the rate of diffusion of the volatile materials through the liquid, there is a tendency for the surface layers to become poorer in the volatile constituents. This leads to a falling off in the gross rate of evaporation and the fractionating power of the still is reduced. Various modifications of still design have been described, as will be indicated later, to increase the turbulence of the falling film, or by centrifugal action to ensure that fresh surfaces of liquid are continually exposed.

Pros and Cons

Two serious disadvantages associated with molecular distillation are (a) the low thermal efficiency, and (b) the poor fractionation obtained.

The most serious cause of the low thermal efficiency is the high radiation loss amounting in some cases to nearly 60 per cent. of the total heat supplied, while the heat directly employed for distillation is only about 9 per cent. of the total. In a molecular still large surfaces are provided with a comparatively great temperature difference between them. Reduction of the temperature difference (involving less drastic cooling of the condenser) will lead to re-evaporation of the condensed molecules and attendant reduction in the distillation rate, consequently a practical limit is imposed.

In normal distillation procedure there is opportunity for both condensation and re-evaporation of molecules produced from the original liquid. In designing fractionating columns the main principle involves condensing a part of the distillate with subsequent interaction between this liquid (the reflux) and the vapour stream. By these methods fractionation is obtained. Such a procedure is not easily possible in molecular distillation, resulting in poor fractionating power in the process. In the subsequent description of the degassers, pumps, stills, pressure gauges and methods of pre-treatment adopted in molecular distillation, an attempt will be made to show how these various limiting factors and handicaps may be reduced or at least partially overcome.

Before proceeding to more detailed accounts of the process, the outstanding advantages of this method of distillation may be noted and the reasons for its commercial development and importance outlined. The two salient features of the process, the extremely low pressures and the relatively short path of travel of the evolved vapours lead to the very marked facts:

(a) Distillation takes place at temperatures about 100° C. lower than the boiling point under normal high vacuum conditions.

(b) The liquid is exposed to the distillation temperature for only a brief period.

(c) Only comparatively small quantities are involved at any given moment, the system being rendered highly flexible and very sensitive to regulation.

Notable among the applications of the process has been the separation and purification of highly thermo-labile vitamins. The low distillation temperature and the brief period of exposure necessary allow the separation to be effected well below the point of thermal decomposition. Detwiler and Markley⁵ give the following list of applications:

(i) The separation and purification of long-chain hydrocarbons, alcohols, fatty acids, esters and glycerides (hitherto distillable only with great difficulty and in certain cases of animals and vegetable fats wholly undistillable); (ii) the separation of polymerised and unpolymerised fractions of vegetable fats and oils; (iii) the purification of amino-acids, sterols and hormones; (iv) the production of vitamin concentrates and anhydrous enzyme preparations; (v) the separation of organic salts of the rare earth metals.

The economics of the process are poor, restricting the application on a commercial scale to the concentration and purification of costly materials not readily treated by any other means.

Details of Technical Operation

The account which follows deals with the process and technique of molecular distillation. The commercial application, together with a description of laboratory investigation carried out mainly on vitamins, will be described in a subsequent article.

Condensation and Fractionation Pumps. The successful operation of molecular distillation stills lies in effecting exceedingly high vacua. These high vacua may only be attained by the installation of efficient pumps which must not only exhaust to a pressure of less than 10^{-3} mm., but be capable of handling large volumes of gases at these very low pressures, for the pumps have to deal with dissolved air, permanent gases, and various substances which exist in the gaseous state at low pressures, but which condense to liquids as the pressure increases toward atmospheric. The only apparatus capable of exhausting to such low pressures are condensation pumps backed by rotary oil-sealed pumps exhausting directly to the atmosphere or by steam jet injectors.

In the original type of condensation pump—mercury vapour pump—suggested by Gaede, Langmuir and others, mercury is vaporised and the stream of vapour, issuing from a jet, sweeps the gas from the vessel to be evacuated. The mercury vapour is condensed in a water-cooled trap, returning to the pump boiler, while the gases after passage through a mechanical pump are exhausted to the atmosphere. Mercury vapour pumps are subject to a number of disadvantages in the production of very high vacua required for molecular distillation, *viz.*:

- The relatively high vapour pressure of mercury.
- The objectionable nature of mercury vapour.
- The necessity for a trap cooled by liquid air or solid carbon dioxide to prevent vapour diffusing back into the evacuated vessel.
- The decrease in pumping efficiency if any grease exists in the pump.

Extensive research work was put in hand to develop more efficient condensation pumps, aiming firstly at the investigation of pumping liquids more suitable than mercury, and secondly at improved construction of the pumps. In 1929 and 1930 two new types of pumping fluid were proposed. C. R. Burch¹ discovered that certain high-boiling fractions, separated during the vacuum sublimation of petroleum residues, could be applied in condensation pumps. Some of these oils, now produced in large quantities for this purpose and marketed under the trade name "Apiezon products," have vapour pressures less than 10^{-6} mm. at room temperature and may be used without the customary cold trap. Very shortly afterwards Dr. Hickman, of Distillation Products, Inc.,⁶ proposed the use of high-boiling liquids, claiming that N-butyl phthalate and benzyl butyl phthalate formed efficient substitutes for mercury, producing high vacua where a cold trap is undesirable. Subsequent research by Hickman and his collaborators⁷ led to the development of less volatile and still more efficient organic compounds, the sebacates proving much more satisfactory than the phthalates; 2-ethyl hexyl sebacate (marketed under the trade name of "Octoil S") has given the best vacua with pressure of 10^{-9} mm. at room temperature.

The lowest pressure attainable in a condensation pump should correspond with the vapour pressure of the working fluid in the coldest part of the high vacuum side of

the system. In the case of mercury the value obtained corresponds well with the theoretical, but with organic pumping substances varying results, diverging very widely in some cases from the predicted values, were frequently encountered. As indicated by Burch and Bancroft⁸ in their original patent and later proved by Hickman,⁹ the explanation of this anomalous behaviour was the lack of homogeneity of the organic substances. Even the most carefully prepared organic fluid is liable to contain traces of constituents some lighter and some heavier than the main bulk, the presence of the lighter fractions most seriously impeding the attainment of high vacua. During the operation of a two-stage condensation pump the lighter constituents tend to accumulate at the point of highest vacuum, and may be redissolved to a greater or lesser extent, contaminating the cold condensate as it returns to the boiler. Hickman⁹ points out that the redissolution of vapours is more pronounced in the inverted type of pump than in the simple vertical pump, the chimney forming a miniature fractionating column at the top of which the highly volatile fraction collects. Hickman also showed that the field of use for these organic fluids could be extended by suitable modification of pump design. Such modifications should be along two lines, one giving a multi-compartment pump where the oil constituents could be separated in the proper order to give continuous fractionation and purging, and the other developing a fractionating column to purify the liquid before it reaches the jets.

Extensive investigations^{9, 10, 11, 12, 13} have led to the development of very efficient types of fractionating diffusion pumps incorporating the modifications referred to above.

(To be continued)

A CHEMIST'S BOOKSHELF

ACID-BASE CATALYSIS. By R. P. Bell. Oxford: The University Press. Pp. 211. 12s. 6d.

In the foreword, this book is represented as an attempt to assemble the different aspects of acid-base catalysis into a picture suitable for university students of chemistry. In our view it is even more suitable for post-graduate students and specialists in this field of research. The subject is dealt with in an advanced manner throughout and care is not always taken to explain the derivation of formulæ; the reader is expected to have a good knowledge of the notation and phraseology of the subject.

The first five chapters describe the laws governing catalysis in aqueous solution, and include elementary accounts of kinetic salt effects and the modern concept of acids and bases—subjects rarely presented in text-books of physical chemistry. Chapter VI deals with non-aqueous solutions, where behaviour is in some respects simpler than in aqueous solutions, though experimental work is much less complete. Finally, Chapters VII and VIII are concerned with the molecular mechanism of acid-base catalysis and the application to catalysed reactions of modern theories of reaction velocity. These topics, still incompletely understood, represent the focus of present interest: for this reason this last section is more tentative and controversial than the rest.

The subject is one which has profound influence on a great many industrial chemical reactions. The classical theory of acid-base catalysis still serves to explain in a general way the observations made experimentally. There are, however, a number of discrepancies, of which the principal is that the reaction velocity is not always a linear function of the hydrogen or hydroxyl-ion concentration as calculated from the conductivity. In particular, in catalysis by solutions of strong acids, an increase of acid concentration invariably causes the velocity to increase more rapidly than the conductivity. The reaction velocity is often affected considerably by the presence of neutral salts and the addition of a salt having an ion in common with the catalyst usually does not depress the velocity as much as would be expected from the simple law of mass action. The newer modifications of the classical theory introduced to explain these discrepancies are: (1) The ionic

concentrations of strong electrolyte solutions are not directly proportional to their conductivities; (2) the simple law of mass action does not apply exactly to ionic equilibria; (3) the reaction velocity in ionic systems is not exactly a linear function of the concentrations, but depends on other properties of the solution; (4) hydrogen and hydroxyl ions are not the only catalysing species.

It is interesting to notice that in modern terminology two of the classical definitions have now become: "An acid is a species having a tendency to lose a proton"; and "A base is a species having a tendency to add on a proton." Definitions have evidently advanced to a point at which they can only be understood by the advanced student. This book is to be recommended as a thoroughly satisfactory account of the modern development of this important subject and should be in the hands of every chemist whose work touches upon it.

KNOTTED STRING. By Harry Brearley. London: Longmans. Pp. 198. 10s. 6d.

All too often the life stories of industrial chemists remain untold except to a few friends. Harry Brearley, the inventor of stainless steel, has broken this unwarrantable custom and has placed on record the story of his career, "the autobiography of a steel maker." The book paints a clear picture of the life of an analytical chemist in the 1870's and the gaunt existence of the Victorian steel makers. One of eight children, Harry Brearley was born in Ramsden's Yard, a Sheffield slum; his parents were of country stock, attracted from their rural environment by the lure of the money to be earned in the industrial centres. By intensive study he educated himself and after his first entry into a steel works as dinner-carrier, rose stage by stage to the position of bottle-washer and then to laboratory assistant. The chapters dealing with these early years are intensely interesting, being half historical and half the personal account of Brearley's fight against life in a slum. In the background is the "hard brutalising work associated at that time with iron and steel-making." Much of his success was due to the encouragement of James Taylor, the chemist in charge of the laboratory where Harry Brearley worked. The title of the book is derived from this period; it was one of his jobs to tie together short pieces of string which were then preserved, but in fact were never used. In 1904, he went to Riga as chief analyst to the Russian branch of a Sheffield steel works. Here he worked as a labourer, then as works manager during the revolution of 1905, when he held lectures in underground cellars. On his return to England Brearley held the enviable position of being works chemist without having to do the routine work, which he refused to undertake. Throughout the book are valuable observations on a managerial side of a factory, social conditions, and education. The author confesses to being a rebel with a love for the provocative. The style of the book is easy; it is non-technical and should appeal widely. For those intent on a career in chemistry it reveals the difficulties of a past age; to their elders it will recall half-forgotten times.

RESEARCHES ON THE STRUCTURE OF ALLOYS. By W. Hume-Rothery, M.A., D.Sc., F.R.S. London: The British Non-Ferrous Metals Research Association. Pp. 20. 2s. 6d.

This brief and clear review sets out the plan, aims, and main conclusions of the author's researches on metallic alloys carried out in the laboratories of the University of Oxford over a period of 15 years. This work has been directed mainly to the establishment of the general principles which decide (1) whether and in what proportions two or more metals are capable of forming solid solutions, (2) the structural and equilibrium characteristics of alloy systems, and (3) the properties of alloys; in fact, on the general principles of physical metallurgy. It has even been found possible to indicate broadly the experimental results obtained and the evidence on which the conclusions rest. A list of the papers published on the subject is appended to the report. Dr. Hume-Rothery's work is of fundamental importance to all interested in the scientific study of metals and alloys.

LETTER TO THE EDITOR

Recovery of Used Lubricating Oil

SIR,—The re-use of waste material has always been an interesting problem in technology, whether it applied to metals, paper, traces of copper in the electrical industry, the reclaiming of solvents, waste rubber or the reclaiming of used mineral oil, etc. In normal times these matters could be dealt with from the economic point of view; in times of emergency their importance rests almost exclusively in the recovery of the materials themselves.

The article entitled "Recovery of Used Lubricating Oil" by Mr. J. E. Walker, published in *THE CHEMICAL AGE* of September 20 and October 4, 1941, has raised the very important question of the recovery of used mineral oil. The article referred to interested me very much indeed because of the practical way in which this entire question is dealt with. In respect of the working methods, however, slight variations or changes could be introduced to suit individual cases, although this is not as decisive a feature of the matter as the fact that so important a problem as the recovery of used lubricating oil should receive due attention.

On October 25 *THE CHEMICAL AGE* published a letter written by Mr. L. Soual which commented upon Mr. Walker's views, and from the technical information given by Mr. Soual it is possible to follow the adaptation of the existing processes to the available oils and the working possibilities.

There is no doubt, as Mr. Walker points out, that the oils must be allowed to settle before they are reclaimed, so that water, mechanical impurities, etc., can be removed. Only after this settling has taken place (which is approximately equivalent to the removal of mechanical impurities, salt and water from the crude oil) should a mechanical treatment be carried out, and where chemical treatment is involved (*viz.*, acid is used), undoubtedly the views expressed by Mr. Walker in his letter to *THE CHEMICAL AGE* of November 22 are very valuable indeed, and by the use of sulphuric acid or other chemical or chemicals a most interesting field of research is open in attempting to find a useful application for this sludge.

Generally speaking, only little interest has been given to this sludge because, till now, economy did not demand it, and it is only the work of Petroff, Pilat and a number of others, mostly carried out here or in the United States of America, which has led to very important uses for it. (*Annual Review of Petroleum Technology*, 6, p. 229).

Regarding Mr. Soual's statement: "From our experience we venture to say that it is impossible to forecast the acidity of a treated oil by any of the methods mentioned as this depends largely on the origin and condition of the used oil. In most cases steps must be taken to neutralise after treatment," I am afraid I am not quite able to share this point of view because the oils to be treated would naturally be subjected to corresponding preliminary tests in the laboratory and the reclaiming process would then be carried out according to the results of the laboratory tests. I have obtained from local garages waste oils of the kind usually disposed of for fuelling, and it was not at all difficult to obtain therefrom standard lubricating oils having exceptionally low acid numbers, flash-points above 230°C., normal viscosity and no ash.

Since the last war the regeneration of all possible kinds of wastes and used oils, too, has been systematically carried out in Germany. Regional depots (24) were set up where the waste collected from garages, workshops, etc., could be treated; apart from these regional depots, however, the large electro industries, transport companies and some others had fairly large regeneration plants of their own. These were, among others, the Rheinisch-Westfälische Elektrizitätswerke, the Berliner Elektrizitätswerke, the Allgemeine Elektrizitätsgesellschaft, and the Pommersche Ueberlandselektrizitätszentrale. In these plants almost exclusively transformer oils and turbine oils, as used by the various concerns, are kept in constant circulation. In this way, first-class oil is always available to these nerve centres of industry. During the last war there was not so much difficulty about obtaining lubricating

and fuel oils as there was with transformer and turbine oils, but the greatest problem lay in the supply of transformer oils because after the curtailment of the Russian oil supply one fire after another broke out in the transformer stations. Not until systematic recovery took place were the difficulties satisfactorily overcome; this state of affairs prevailed until 1928 when it became possible to supply American oils manufactured according to the Edeleanu process for transformers. Even so, these large concerns maintained the regular circulation by regeneration by means of sulphuric acid and earth treatment; either special activated earth or very small quantities of lime added to the clay are used systematically.

In the electrical industry the Studiengesellschaft für Höchstspannung followed this subject very closely. The chemical side of it was in my hands, so that I was able to study the advantages and disadvantages of the problem from close quarters, and I hardly believe that continental countries will ever again abandon the reclaiming of oil, etc. It is striking that this system of recovery is being adopted more and more in the United States of America, according to reports in technical journals coming from that country.

In the case of oils in circulation in the electrical industry and the large transport concerns (among the latter I should like to mention the Verkehrszentrale of "Free" State [!] Saxony) the loss in oil-recovery was not more than from 5 to 8 per cent., and in the regional depots, where the oil was collected from various other sources, it averaged between 20 and 28 per cent. With the return to normal conditions, the question will need to be dealt with anew, irrespective of its influence on peace-time industry and commerce.

I warmly appreciate the fact that Mr. Walker has brought this matter to discussion, and can only thank him and Mr. Soual for the incentive created by their contributions to *THE CHEMICAL AGE*.—Yours faithfully,

Franks Laboratories, Ltd.,

FRITZ FRANK.

London, S.E.23.

December 10, 1941.

New Control Orders

Control of Tin

THE Minister of Supply has made the Control of Tin (No. 3) Order, 1941 (S.R. and O. 1941, No. 1980), which came into force on December 9. Under this Order any person holding any tin in the form of ingot, slab, block, bar, stick, grain tin or granulated tin, other than a person carrying on an undertaking which involves the treatment, use, or consumption of such tin, is required to hold that tin at the disposal of the Minister of Supply and to send forthwith particulars of quantities, qualities, and location of his holding to the Joint Controllers of Non-Ferrous Metals, Grand Hotel, Rugby. This requirement applies both to tin situated in the United Kingdom and to any tin which subsequently arrives in or is produced in the United Kingdom. Further, no person can acquire any tin in the above forms or tin scrap, ore, concentrate, residue, slag, dross or sludges without a licence from the Minister, or dispose of such materials unless to the holder of a licence.

Starch and Dextrine

By the Starch and Dextrine (Control) Order, 1941 (S.R. and O. 1941, No. 1991), which came into force on December 15, the corresponding Order of 1940 (*see THE CHEMICAL AGE*, January 18, 1941, p. 49) is revoked, except that licences granted under that Order shall continue to have effect. By the new Order no starch, flour, or dextrine made from sago or tapioca may be used for any purpose; no starch or dextrine may be sold or bought by wholesale except for resale by retail. Records respecting dealings in starch or dextrine shall be kept and made available for inspection by authorised representatives of the Minister of Food, and returns relating to such dealings shall be furnished from time to time as required by the Minister.

COLLECTED NOTES ON CHEMICAL SAFETY

Explosions in Stills and Reaction Vessels

by JOHN CREEVEY

HEREWITH is a further selection of notes making for safety in industrial chemical practice, continued from p. 257 of our issue of November 15.

Salicylic Acid: Vapour from Rapid Heating.

Rapid heating is desirable for the subliming of salicylic acid, if there is to be no decomposition; when heated slowly, a considerable part may decompose into phenol and carbon dioxide. An explosion of gas-heated copper stills engaged in subliming salicylic acid (*Nat. Fire Protect. Assoc. Quarterly*, 1918, 11, 308) was primarily due to overheating, giving an excessive production of vapour; abnormal air currents aided the ignition of the inflammable vapour, which struck back to the stills.

Safety Fittings in a Still: Choking by Sublimed Solids.

Additional care must be exercised when "closing down" or "starting up" a still where the charge carries volatile solids, or where some product is liable to sublime from the residue at the end of the distillation or in the early stages of heating. The explosion of a cast iron still used in the manufacture of an ammonia product (*Chem. Tr. J.*, 1922, 71, 234) appears to have been caused by excess pressure which developed after "crystals" had formed and choked the vapour exit and connections to pressure gauge and safety valve. Two persons were killed.

Water-sealed Vents: Effect of Severe Weather.

A safety device which proves satisfactory under one set of conditions may fail under another, although there is no reason to expect failure. A carbon disulphide still was provided with a water-sealed vent, because the corrosive nature of the vapour did not allow the use of a safety valve of ordinary type. The explosion of this still (*Ann. Rep. Insp. Factories*, 1924) was due to excessive pressure formed as a result of the freezing of the water in the vent during exceptionally cold weather. The water in the vent had been known to freeze when the still was idle, but it was assumed that freezing could not take place when the still was in operation. It is never wise to assume safety.

Nitrobenzol: Localised Overheating.

Products which are liable to contain a dangerous impurity should be distilled by steam heat, and not by direct heat which may easily cause local overheating. Irrespective of the precautions taken normally against the formation of explosive di-nitro products in nitrating processes, their absence is not always assured. The explosion of a fire-heated still engaged in the distillation of nitrobenzol (*Ann. Rep. Insp. Factories*, 1920) was due to the presence of dinitrobenzol, which came in contact with an overheated part of the still. Two persons were killed.

Leakage of Vapour from Choked Pipes: Sparks from Motor or Switch.

It is the periodical inspection of plant that reveals such sources of danger, as where a pipe becomes choked with "dust" carried over from a reaction vessel under vacuum. Two persons were killed, and four others injured, by the explosion of plant producing "proof" alcohol by the lime method (*Chem. Met. Eng.*, 1921, 25, 343). The plant comprised a steam-heated rotary drier under vacuum, dust trap, and distilling column. Leakage of alcohol vapour resulted when lime dust began to choke the pipe between trap and distilling column. When this leakage was noticed, the switch controlling the agitating device in the drier was cut off; the explosion that followed seems to have been due to a spark from the switch (knife pattern) or the motor (open unprotected type). The sequence of the events was: choking of pipe, leakage of inflammable vapour, ignition by spark from switch or motor, explosion at source of vapour. A periodical inspection of the plant would have revealed the accumulation of lime dust, which, in spite of the provision of the dust trap, collected

in one of the pipes. The need is also emphasised for all electrical equipment to be of safe type wherever inflammable liquids or vapours are present.

Unsuspected Hazard, with Mercury Pressure.

A carboy in use as a montejus for raising concentrated ammonium hydroxide had an iron U-tube containing mercury to act as safety valve. The explosion reported (*Science*, 1927, 65, 63) was believed due to mercuric azide which had formed by the continuous exposure of oxidised mercury to the action of the ammonia vapour.

Tar Stills: Danger from Residual Vapours.

Tar stills have to be steamed out after "closing down," as a precaution against the explosion of residual vapour as well as gassing accidents. Precautions were formulated by the A.B.C.M. jointly with the Association of Tar Distillers, and were printed for the first time in 1925 (*Ann. Rep. Insp. Factories*, 1925, p. 34) and subsequently issued as Chemical Works Regulations (Preparation and Testing of Tar, Benzol and Oil Stills, and Closed Tanks). Before this (*Rep.* 1922, p. 31, and 1923, p. 33) there had been reference to the so-called "tally" safeguard giving permission for workmen to enter a tar still, the tally being a certificate from some responsible person to the effect that the still has been inspected and found safe, and that it has been isolated from sources of gas or fumes. Subsequent to this (*Ann. Rep. Insp. Factories*, 1927) an explosion occurred while "scraping out" some tar stills by means of long iron bars inserted through hand-holes. The explosion was due to a residual mixture of light oil vapour and air in the stills, and the spontaneous ignition of carbon detached from the walls of the stills by the scrapers. If these stills had been steamed out after closing down, as advocated, the ignition of the carbon (if it still took place) would have been of no consequence in the absence of dangerous vapour in the stills. When safety measures are recommended, why does some time elapse before they are rigidly observed?

Explosive Violence from Temperature Rise: Choked Cocks.

Reactions can reach the point of explosive violence if there is an uncontrolled rise in temperature. Dangerous conditions in the nitration of toluene occur with increased speed of running the toluene into the mixed acids, and from imperfect agitation or inefficient cooling to disperse the heat of the reaction (*Servise des Poudres*, 1923, Adm. Doc. 391). There may be accessory factors in reaching final disaster, as where the cock on the supply pipe feeding the organic liquid becomes inoperative or even difficult to close in the emergency of an unexpected rise in temperature, or where a belt slips from its pulley and the stirring gear is temporarily out of operation. An explosion from the first cause (*Chem. Tr. J.*, 1924, 75, 33) resulted in two deaths and four injuries to personnel; if there had been two cocks on the supply pipe it is unlikely that both would have suddenly become inoperative.

Autoclaves: Ignition of Escaping Vapour.

A sudden increase in pressure by nature of the reaction must be watched in the operation of autoclaves where working conditions have not been standardised in terms of temperature rise per unit of time and speed of stirring. An autoclave engaged in making dimethylaniline by heating commercial aniline and purified aniline hydrochloride at 240-260° C. (*Chem. Met. Eng.*, 1922, 27, 1044) showed a sudden rise in pressure from 112 to 250 lb./sq. in., but it was escaping vapour from the safety valve which ignited and struck back to cause the explosion. The autoclave had been tested to 750 lb. pressure, and would have been able to withstand the increase in pressure noted by the pressure gauge, but not that resulting from the ignition of the contents. One person was killed and one injured.

Flame-Proof Induction Motors

Design for Safe Operation with Inflammable Vapours

by H. SEYMOUR

THE outstanding economic and technical advantages of the electric drive have enabled the electric motor to penetrate into fields where previously, on account of explosion risk, only compressed air or steam engines, for example, could be used. For instance, in coal mines where there is always danger from fire-damp, regulations stipulate that not only must all those parts which are liable to spark regularly while the motor is running be protected against explosions, but also that the motor itself is to be so designed that no explosion occurring inside the motor (e.g., from a breakdown of the insulation between the windings) shall pass out to the surrounding atmosphere, or alternatively that it shall be impossible for any explosion to occur within the motor. Similar stringent regulations are in force in works handling explosive products.

Output Conditioned by Weight

Pressure-proof enclosed motors are very heavy and expensive, owing to the absence of cooling by fresh air and on account of the necessary thickness of the flanges and of the motor casing, which must be designed to withstand the full force of the explosion. Their use is therefore confined to relatively low ratings. To enable the size of the motors to be kept small, motors with pressure-proof enclosures are also made with frame cooling. In this type, the motor draws in air from the surrounding atmosphere and forces it through the space between the explosion-proof casing and the external casing, thus providing an additional means of conducting away the heat.

In motors with pressure release, thanks to the self-ventilation of the motor with air from the surrounding atmosphere and to the reduction of the maximum pressure of the explosion by the ventilating openings, smaller models with thinner walls can be made, thus considerably raising the limiting output. The ventilation openings must, however, be covered with a device to cool off the hot gases produced by an explosion in the motor as they escape, so that they do not ignite the mixture of air and gas in the room where the motor is installed. Plate protection, which generally consists of a number of parallel plates not more than 0.02 in. apart and at least 2 in. in width, is most generally used, but requires frequent cleaning to prevent the openings from becoming clogged. It is, moreover, very sensitive to mechanical damage, as, should only one of the spaces between the plates increase beyond the permissible limit, the whole system ceases to be an effective protection.

Cooling the interior of the motor with fresh, gas-free air by means of a separately-mounted fan precludes any possibility of an explosion, provided that there is some safety device which enables the motor to be started up and kept running only if the pressure inside the motor casing exceeds a certain amount, thus ensuring that no gases can penetrate into the motor from the surrounding atmosphere while the motor is running, should the joints not be completely gas-tight.

On account of the long air conduits necessary and the difficulties of erection, forced draught cannot be used everywhere (for example, underground), and it is, in any case, employed as a rule only for motors of larger power in view of the auxiliary equipment required.

Slip-Ring Motors

Motors fitted with pressure-proof enclosure of those parts liable to spark in service are used in nearly every country and in many industries. In the case of slip-ring motors only the slip rings are enclosed in an explosion-resisting cover, and in motors with centrifugal starters only the switching mechanism. The design of an explosion-resisting enclosure of this type must take into account all the phenomena occurring in the most unfavourable circumstances when the particular gas explodes, e.g., the speed

at which the pressure rises, the maximum pressure and temperature of the burning gas, and the speed at which the gas escapes through the packing glands. The force of the explosion, as determined by these characteristics, depends, for any particular design of enclosure, chiefly on the chemical composition of the gas and on the proportions in which the gas and air are mixed. Thus, the force of an explosion of methane and air (fire-damp) is appreciably smaller than that of a hydrogen-air mixture, as shown by a comparison of the force exerted by the most explosive mixture of each gas. This fact must be taken into consideration when designing the explosion-proof protection, and a motor intended for use in places where fire-damp is present must be different from one used in atmospheres containing hydrogen.

In addition to the pressure-proof enclosure of the previously mentioned parts of the motor, other precautions are usually taken to ensure maximum reliability for the whole motor. For example, the parts of the motor under tension are mechanically protected against accidental contact, and against the entrance of foreign bodies; and the windings are guarded from the effects of very damp air at high ambient temperatures by the use of special (tropical) insulation. If required, the motors are made with a specially large air gap. All terminals are secured by special means to prevent their working loose.

Squirrel-Cage Motors

In squirrel-cage induction motors, since there are no parts subject to regular sparking in service, the flame-proof protection is confined to general measures for increasing reliability, as just mentioned. The field of application of this type of motor is confined to drives where speed regulation is not demanded. They are best suited to machines which do not call for heavy starting torques, e.g., centrifugal pumps.

In slip-ring induction motors, the slip rings are arranged in some designs outside the bearing in a pressure-proof two-part casing. The part nearest the motor is provided with flame-proof glands for the shaft and cables and with a built-on terminal box. The other part consists of an easily removable mild-steel cover, secured to the fixed part by a hinged ring with toggle fastening, which, in combination with conical flanges, enables the enclosure to be made absolutely flame-proof. A padlock prevents the cover from being opened by unauthorised persons.

Hydrogen-Air Mixtures

Explosions of hydrogen-air mixtures are particularly dangerous on account of the high temperature developed and the great speed at which the gases produced escape through the packing glands, in addition to the higher pressure of the explosion. Thus, flame-proof enclosure of the slip rings (or of the switching mechanism of centrifugal starters), which may be quite suitable for use against fire-damp, is quite inadequate as a protection against explosions of hydrogen-air mixtures. Numerous tests made on motors running in atmospheres of hydrogen and air have shown that with slip ring motors, for example, in which the cover is not specially cooled, it is necessary to provide, between the cover and the shaft, a labyrinth packing with very long glands. To ensure, however, that this design affords absolute protection against the speed of an explosion to the outside atmosphere, the glands must be made extremely accurately, and must receive careful attention during service.

These difficulties have been overcome by an enclosure with natural ventilation. The pressure-proof cover enclosing the slip rings is connected with the hydrogen-free atmosphere outside the machine room by two pipes of small internal diameter. Owing to the great difference between the specific weights of air and hydrogen, the hydrogen

escapes from the cover entirely of its own accord, *i.e.*, without the aid of a fan, leaving only an exceedingly small and quite harmless amount inside the cover.

When the motor is to be erected in places where the only explosive gas present in the air is hydrogen, the two following methods of protection can be adopted instead of the slip-ring enclosure with natural ventilation, according to working conditions and the facilities for installation. The standard type of pipe-ventilated motor with internal, non-protected slip rings or centrifugal starter requires no separate fan, because the simple, natural ventilation conducts away the hydrogen from inside the motor when it is not running. While the motor is running, its fan draws in fresh air through the suction pipe, and, after this has passed through the interior of the motor, it discharges it again through the pressure pipe. Thus the slip rings (or the centrifugal starter) and also the windings, are protected from hydrogen. The motor with inside slip rings is provided with the normal type of protection, *i.e.*, non-pressure-proof. Dangerous accumulation of gases inside the motor is entirely prevented by the automatic natural ventilation by means of the two pipes. Again, in this type, the slip rings and windings are protected from hydrogen.

Application of Motors

As far as the application of such motors is concerned, in coal mines they are used chiefly for driving the dewatering pumps, mine hoists, endless rope and chain haulages, shaker conveyors, coal cutters, compressors and other plant. In modern generating stations with boilers fired by pulverised coal, motors with flame proof protection are used for driving the pulverisers. In oilfields they are utilised for driving well-boring equipment and the accompanying mud pumps, oil hoists, oil pumps and natural-gas compressors. When these pumps and compressors are used for transmitting the oil and natural gas from the wells to other points, more or less distant, the pipe lines may be several hundred miles long, and high-powered motors are required. Electrical equipments are also employed for driving portable oil-well cleaning hoists, the complete equipment being mounted on a truck built up of angle iron and steel plates so that it can be readily moved on to another well when one has been cleaned.

In certain parts of the gasworks (*e.g.*, near the retorts, in the screening and compressor rooms), highly explosive mixtures of hydrogen and coal gas may be present, and therefore only motors with hydrogen-ignition-proof protection should be employed. It is also advisable to use motors with flame-proof protection for certain purposes in metallurgical plants (for example, near gas producers), where large volumes of explosive gases escape and accumulate.

Recently, numerous works for manufacturing synthetic nitrogen products have been started up, employing large numbers of electric motors, from small up to quite high ratings for driving compressors and pumps, most of which must have explosion-proof protection. Hydrogen produced in various ways (*e.g.*, from coke-oven gas, by the electrolysis of water, or from water gas) is made to combine catalytically at high temperature and pressure with the nitrogen in the air. The possibility of hydrogen escaping from pipes and machines through leaky joints or packings entails the ever-present risk that explosive mixtures may accumulate in the machine rooms. Regulations therefore exist in some countries requiring that the motors installed in certain rooms be provided with hydrogen-ignition-proof protection.

In the low-temperature coal carbonisation industry similar requirements are placed on the electric motors for driving pumps, compressors, centrifugals, and other plant; and in numerous other applications of the chemical industry motors with explosion-proof protection are essential.

Imports of zirconium ore, including zirconium sand, into the United States for the first seven months of 1941 were 30,765.596 lb. compared with 33,690,509 lb. for the whole of 1940 and only 6,865,026 lb. in the year before.

Electrolytic Permanganate

Anodic Preparation from Ferro-Manganese

FOR nearly 40 years unsuccessful attempts have been made to prepare permanganate by anodic solution of ferro-manganese in a diaphragm-free cell. For unknown reasons, the anodes used had a tendency to become passive and would fail to dissolve. In some cases they would become covered with a layer of manganese dioxide, the current density would drop, the potential rise, and the production of permanganate would not only cease, but that already produced would be largely decomposed into manganese dioxide.

The process has been investigated by A. Lowry, of Modane-Fourneaux, Savoy, France, who empirically determined optimum conditions. Results reported by him to the Electrochemical Society in Chicago indicate that it is possible to prepare a commercial grade of permanganate by anodic solution of ferro-manganese, provided that conditions for operating the cell are relatively rigid. The author stated that Electrolytic permanganate thus prepared is cheaper than that made by the older straight chemical processes.

It was found to cost more to produce potassium permanganate by electrolysis directly than first to produce sodium permanganate and then convert this to the potassium salt by double decomposition with KCl. Recommendations for commercial production of KMnO_4 were as follows:—

Electrolyte: solution of 200-220 g. of caustic soda per litre.

Anodes: ferro-manganese containing 70-75 per cent. manganese and 5-6 per cent. carbon.

Cathodes: copper or iron tube helix, water-cooled.

Current concentration: 12-25 amp./litre.

Current density: 15-30 amp./sq. dm. at the anode and 5-10 amp./sq. dm. at the cathode.

Bath temperature: 10°C.

Duration of electrolysis: 3-4 days.

The end of each individual cell run corresponds nearly to saturation of the electrolyte with sodium permanganate. The cell voltage has then risen to 5-6, as against 3-3.5 during the first day's operation of a freshly charged cell. A little NaOH solution is added so that at the end of the third or fourth day there may still be at least 40 g. per litre in the bath. On completion of the run, the cell solution is decanted, treated with chlorine and then with air to expel excess chlorine. Next KMnO_4 is precipitated by addition of KCl to the solution.

Average current efficiency of the cell is about 25 per cent., and the net energy consumed, on the basis of solid, dry KMnO_4 crystals, is about 25 kWh per kg. of KMnO_4 . The conversion of the manganese in the ferro-manganese anodes is relatively high, but a considerable proportion of NaOH is lost by conversion to carbonate and chloride.

Preparation of Aliphatic Amines

High Pressure Method of Reduction

IN reducing fatty acid amides to the corresponding amines a good result can be obtained by operating under high pressure, preferably between 180 and 200 atm. at 250°-270°C., according to Ueno and Takase (*J.S.C.I. Japan*, 1941, 44, 29B, reported in *Chem. Met. Eng.*). With dioxan as solvent and a copper-chromium oxide catalyst the principal product is a secondary amine, *e.g.*, dioctyl and didecyl amines from caprylic and capric amides respectively, or dicetyl amine from palmitic amide. Under the stated conditions reduction can be completed in about 30 minutes. A small amount of a barium promoter in the copper-chromium oxide catalyst is a useful aid to rapid and complete reduction. At least three times as much dioxan as acid amide should be used as the reaction medium. A small autoclave, arranged for mechanical shaking during the reaction, is suitable. At the end of the reduction the mixture is filtered. Secondary amines are recovered from the filter cake and primary amines from the filtrate. *

Personal Notes

MR. E. G. SPOONER has been authorised by the Central Government of India to exercise all the powers of the Iron and Steel Controller.

MR. SYDNEY D. KIRKPATRICK, editor of *Chemical and Metallurgical Engineering*, has been elected president for 1942 of the American Institute of Chemical Engineers.

MR. STANLEY B. ROSSER, Penarth, has been co-opted on to the area committee of the Oil Distributors' executive council for the West of England and South Wales.

MR. ARTHUR E. SYLVESTER, who recently became general manager of The Gas Light and Coke Company, has been appointed Deputy Regional Fuel and Power Controller for the London region.

MR. LOUIS WEISBERG was elected president of the Association of Consulting Chemists and Chemical Engineers of America at its annual meeting at The Chemists' Club, New York, on October 28.

COUNCILOR A. J. GILLIAN, General Secretary of the Chemical Workers' Union, and a member of the Southwark Borough Council, London, has for the tenth year in succession been elected chairman of that authority's Public Health Committee.

MR. W. H. ROBERTS, M.Sc., F.I.C., who normally would have retired from his post of city analyst to the Liverpool Corporation on reaching the age of 65 on January 11, has had his engagement extended for a period not exceeding 12 months.

MR. DUNCAN A. MACINNES, of the Rockefeller Institute for Medical Research, has been chosen Nichols Medalist for 1942 for outstanding investigations on electrolytes. The medal will be presented at a meeting of the New York Section of the American Chemical Society on March 6.

MR. MALCOLM MCFARLANE LOVE, of Paisley, has been appointed borough analyst of Burnley. From 1915 to 1917 Mr. Love was works chemist with Messrs. William Wotherspoon, Ltd., starch manufacturers, Paisley, and from 1919 to 1923 he held a similar position with K.O. Cereals, Ltd. Later, he was appointed principal assistant to the Glasgow city analyst.

Obituary

SIR FRANCIS D'ARCY COOPER, chairman of Lever Bros. and Unilever, Ltd., died on Thursday at his home at Reigate, at the age of 59.

A link with the famous chemical firm of Brunner, Mond and Co., Ltd., was severed by the death, on December 10, of LUCY MARIANNE, LADY BRUNNER, widow of Sir John Fowler Brunner, who died at Hovingham Hall, Yorks, aged 69. Sir John, who died in 1929, was on the board of Brunner, Mond and Co., and was one of the original directors of I.C.I., Ltd., resigning his position in 1927.

DR. WILLIAM ALBERT NOYES, news of whose death on October 23, at the age of 84, has just reached us, was a past president of the American Chemical Society and professor emeritus of the University of Illinois. From 1903 to 1907 he was chief chemist of the National Bureau of Standards, and from then until 1926 he was professor of chemistry and director of the laboratories at the University of Illinois. President of the American Chemical Society in 1920, he was awarded the Nichols Medal in 1909, the Willard Gibbs Medal in 1919, and the Priestley Medal in 1935.

We deeply regret to announce that CAPTAIN F. CHRISTOPHER BENN, youngest of the three officer sons of Sir Ernest Benn (chief proprietor of THE CHEMICAL AGE) and Lady Benn, has been killed in action. He leaves a widow and one son. Captain Benn, who was 29, was educated at Harrow and Clare College, Cambridge (M.A.), and on leaving the University relinquished his right to join the family business, preferring to make his own career. He was a barrister of the Middle Temple and in his brief three and a half years at the Bar before the war had already established the foundations of a substantial practice in commercial law. An enthusiastic Territorial, he was in camp when war broke out. He spent six months

in the ranks on anti-aircraft defence and then, because of his knowledge of Italian—he was an accomplished linguist—he was ordered to the War Office and commissioned in the Intelligence Corps. After more than a year of strenuous desk work, he yearned to get back to more active service. Though pressed to accept an appointment in the War Cabinet Department, he declined this and was eventually posted to G.H.Q. Middle East and from there to H.Q. Eighth Army. Music was one of his absorbing interests, and he was interested, too, in boys' welfare work. He was a member of the Council of the Boys' Hostels Association and for a time lived with the boys at King George's House, Stockwell. A man possessed of a keen, perceptive mind and sensitive outlook, he had great personal charm and was rich in qualities that attracted warm friendship.

British Chemical Prices

Market Reports

A STEADY volume of inquiry is reported in nearly all sections of the general chemicals market, and a firm tone prevails throughout. Delivery specifications against existing contracts cover fair quantities. Offers of yellow prussiate of soda and bichromate of soda and the majority of the potash products continue to be on a restricted scale and similar conditions are operating for oxalic acid, tartaric acid and citric acid. An atmosphere of marking time is in evidence in some sections of the coal tar products market, pending the announcement of the basis of the control of cresylic acid and crude carbofic acid. Among the active items, creosote oil is in good demand and there is a fair inquiry for solvent naphtha and xylol.

MANCHESTER.—For the general range of leading heavy chemicals on the Manchester market during the past week fresh inquiry has been on a fairly good scale, with much of it relating to forward transactions, subject to any modification of prices that may occur. In the case of the soda products, as well as of the magnesia and ammonia compounds, contract supplies are being called for fairly steadily, whilst a strong demand continues for sulphuric, acetic, boric and oxalic acids. Values generally are on a firm basis. New buying of some of the tar products is rather quieter, but on the whole, contract specifications are circulating freely.

GLASGOW.—There is a slight improvement in the general chemicals in the Scottish heavy chemical trade both for home and export during the past week. Prompt delivery is becoming very much more difficult on account of the raw material position. Prices generally keep firm at about previous levels.

Price Changes

Carbon Black.—4½d. to 7½d. per lb., according to packing.
Chrometan.—Crystals, 5½d. per lb.; liquor, £24 10s. per ton d/d station in drums.
Citric Acid.—1s. 10d. per lb.
Cream of Tartar.—£17 2s. per cwt., less 2½%, d/d in sellers' returnable casks.
Cresylic Acid.—Pale, 99/100% 5s. 6d. per gal.
India Rubber Substitutes.—White, 6½d. to 9½d. per lb.; dark, 5 9/16d. to 6 3/16d. per lb.
Lead Acetate.—White, £51 to £53 ton lots.
Lead, Red.—English, 5/10 cwt., £47 10s.; 1 cwt. to 1 ton, £47 5s.; 1/2 tons, £47; 2/5 tons, £46 10s.; 5/20 tons, £46; 20/100 tons, £45 10s.; over 100 tons, £45 per ton, less 2½ per cent., carriage paid; non-setting red lead 10s. per ton dearer in each case.
Lead, White.—Dry, English, less than 5 tons, £55; 5/15 tons, £51; 15/25 tons, £50 10s.; 25/50 tons, £50; 50/200 tons, £49 10s. per ton, less 5 per cent., carriage paid; Continental material, £1 per ton cheaper. Ground in oil, English, 1/5 cwt., £96 10s.; 5/10 cwt., £65 10s.; 10 cwt. to 1 ton, £65; 1/2 tons, £63 10s.; 2/5 tons, £62 10s.; 5/10 tons, £60 10s.; 10/15 tons, £59 10s.; 15/25 tons, £59; 25/50 tons, £58 10s.; 50/100 tons, £58 per ton, less 5 per cent., carriage paid.
Potash, Caustic.—Basic price for 50-100 ton lots. Solid, 88/92% commercial grade, £55 7s. 6d. per ton, c.i.f. U.K. port, duty paid. Broken, £5 extra; flake, £7 10s. extra; powder, £10 extra per ton. Ex store, £3 10s. supplement.
Potassium Permanganate.—Technical, £7 2s. 6d. to £8 9s. 6d., according to quantity d/d.
Sulphur.—Finely powdered, £17 10s. to £19 d/d; precip. B.P., 68s. per cwt.
Tartaric Acid.—1s. 3½d. per lb., less 5%, carriage paid for lots of 5 cwt. and upwards.
Tin Oxide.—Snow White, £14 5s. to £14 15s. per cwt.
Vegetable Lamp Black.—£48 per ton.
Xylol.—Pure, 3s. 9d. per gal.

General News

Employees of the Cornbrook Chemical Co., Ltd., Stockport, were recently presented with a new recreation room, the opening ceremony of which was performed by the managing director, Mr. J. G. Ferguson.

The Ocean Chemical Co., Ltd., Ramsbottom, Lancs., were fined £5 recently, at Bury, for an infringement of the black-out regulations; the firm's foreman was also fined £1. It was stated that a glare coming from the 90-ft. chimney at the works was visible a mile away.

A handy pocket diary for 1942 has been issued by Messrs. W. J. Bush and Co., Ltd., Ash Grove, London, E.8, which is particularly welcome in these days of paper shortage. Besides the diary portion it includes useful tables of weights and measures and a syrup table with equivalents in °Tw. and °Bé.

Bequests in the will of Mr. R. J. Flintoff, of Goathland, Yorks, founder of the Northern Ecological Association, include £1000 to the Chemical Society for a medal for the most meritorious contribution to the knowledge of the relations between chemistry and botany; £1000 to the University of Manchester for a prize to post-graduate students doing research work of outstanding merit; and £1000 to the Linnean Society for a botanical research medal.

The German Commissioner for the Dutch company, Lever Brothers and Unilever N.V., has announced that dividends will be paid on the company's preference shares for the year 1940. In consequence, according to an announcement issued by the directors of Lever Brothers and Unilever, Ltd., the English company will be relieved of the necessity to provide against non-payment of those dividends and the total profits carried forward from 1940 will thus form part of the English company's free reserve.

Giving an address on plastics and engineering at a meeting of the North-East Coast Institution of Engineers and Shipbuilders at Newcastle-on-Tyne on December 12, Dr. A. Caress, of I.C.I. (Plastics), Ltd., Welwyn Garden City, said that after the war it would be possible to mention many new applications of plastics. There was a growing demand for plastics, the use of which had received an impetus from the call to save weight. Dr. Caress mentioned that in the *Scharnhorst* extruded plastic insulation had been used in place of heavy lead covered electric cables. Following the address, the M. C. James Medal was awarded to Mr. W. T. Bottomley and the Weighton-Medal to Mr. J. K. Lunde for outstanding papers.

Foreign News

Considerable deposits of mica are reported to have been discovered in Northern Sweden, and exploitation on a small scale has already started.

United States production and shipments of molybdenum (element) were 3,816,600 and 3,093,900 lb. respectively in September, compared with 3,780,300 and 4,264,700 lb. in August.

The U.S. Department of Commerce is to cease the publication of the usual monthly export and import statistics for the duration of the war, says Reuter.

A new Swedish acetone factory of the Co-operative Union, to be operated in conjunction with the Union's new charcoal factory in Northern Sweden, is scheduled for completion in the spring of 1942. The annual output will be 500 tons.

The new laboratory buildings of the Du Pont concern, recently opened at Arlington, New Jersey, will add approximately a third to their research facilities for the investigation and development of plastic materials.

The new French company which is taking over the dyestuffs interests of the three concerns mentioned in THE CHEMICAL AGE of December 13 (p. 300), and of the *Matières Colorantes et Manufactures des Produits Chimiques du Nord*, is to be known as S.A. de *Matières Colorantes et Produits Chimiques "Francolor"*. The I.G. has acquired a financial interest in the new company, but has not made a cash contribution; instead, the French founder firms have been compensated by shares in the I.G. "Francolor" is to start operations on January 1, 1942.

From Week to Week

A hydrochloric acid plant, due to be completed by the spring, is being built by the Ethyl Gasoline Corporation at Baton Rouge, Louisiana. Over a million cubic feet of chlorine gas will be produced each day.

Donau-Chemie A.G., the Austrian subsidiary of I.G. Farbenindustrie, has raised its capital from 12 to 20 million marks, to take over the entire assets of Carbidwerk Deutsch-Matrei A.G. of Vienna.

An all-India register of chemists, both employed and unemployed, is being prepared by the Indian Chemical Society. Those in the latter class will find registration of great service, since the Society intends to put them in touch with employers whenever possible.

An Uruguayan government decree empowers the Banco de la Republica to make application in the supplying countries for export licences covering metals and chemical products, and to effect purchases thereof on account of the State resale to importers and others, at fixed prices.

Cellulosa d'Italia, the Italian 130 million lire company, has opened its first cellulose factory at Chieti, and reports that the two works at Capua and Cuneo will begin operations within a few months. At Chieti and Capua cellulose is made from straw, while the plant at Cuneo is to use chestnut waste.

Increased output of antimony is planned by the semi-governmental antimony mining company in Japan. This step has been taken as a result of the ban recently imposed by Bolivia on exports of antimony to Japan. Current antimony production covers less than a quarter of Japan's consumption, which has risen sharply in recent years.

Two new companies, Stickstoff Ost G.m.b.H. and Superphosphat Ost G.m.b.H., have been formed by the German authorities in order to "advise and support" nitrogenous and phosphoric fertiliser plants in the occupied territories in the East. They are expected to co-operate closely with the German cartels for nitrogen fertilisers and superphosphates.

Production of manganese ore in Brazil during 1940 has been officially recorded at 313,391 metric tons, compared with 257,752 tons in 1939. Almost the entire output was obtained in the State of Minas Geraes. Exports of manganese last year amounted to 222,713 tons, compared with 189,003 tons in 1939, the principal market having been the U.S.A.

Mechanical construction rather than chemical processes and systems makes the strongest appeal to the inventive ingenuity of the Swedish people. According to a report by Mr. H. Ericson, only a few schemes for the production of liquid fuel from native raw material have been submitted to the Swedish Board of Inventions, which began its activities on July 1, 1940.

"Calcioclanamide," the Italian cartel for calcium cyanamide, reports sales of 213,000 (244,000) tons in the fertiliser year ended last June. Owing to reduced imports and depleted stocks, purchases by farmers had to be limited to 70 per cent. of the quantities supplied in the preceding year, but the position is said to have improved now as a result of Government action.

Alcohol production in Denmark declined from the record figure of 11,078,000 litres of absolute alcohol in 1939, to 10,723,000 litres in 1940. Domestic sales of alcohol showed a decrease of 7 per cent. 8,064,000 litres having been sold for industrial use compared with 8,498,000 in 1939. The drop is attributed chiefly to the loss of the market for alcohol in anti-freeze preparations for the motor-car industry.

Magnesite deposits, recently reported to have been found in southern Bahia, Brazil, are estimated to have reserves of about 40,000,000 tons each. The ore of one deposit is said to be of refractory grade, while that of the other is suitable for manufacture of magnesium metal. The company, Magnesite, S.A., organised to exploit the deposits, expects to produce and burn magnesite on a small scale for the Brazilian industries needing refractory materials. Development of the deposits for export would, it is said, require considerable capital.

Company News

Eucryl, Ltd., have declared a dividend of 10 1/6 per cent. on deferred shares (same).

British Celanese, Ltd., have announced a profit of £1,087,521 (£1,556,339).

English Clays Lovering Poching and Co. have declared a dividend of 1 per cent. (1 1/2 per cent.).

Savory and Moore, Ltd., announce a profit for the year to January 31, of £51,922 (£57,847).

British Emulsifiers, Ltd., report a profit for year ended September 30, of £5588 (loss, £5278).

United Match Industries, Ltd., announce a dividend of 50 per cent., less tax, on deferred ordinary shares (same).

William Blythe and Co., Ltd., have declared a half-yearly dividend on the 8 per cent. cumulative preference shares, payable on December 31.

Tube Investments, Ltd., report a net income from subsidiaries and investments of £845,639 (£612,792). Details of the reduced dividend payments were given in this column on November 8.

Fison, Packard and Prentice, Ltd., have declared a final dividend of 7 1/2 per cent., making 10 per cent., for the year ended June 30 (same).

The Associated Manganese Mines of South Africa report a final dividend of 10 per cent., making 20 per cent., for 1941 (12 1/2 per cent.).

The Sulphide Corporation, Ltd., reports net profit for the year ended June 30 of £30,251 (£38,516), and announces that while a dividend of 5 per cent., less tax (same), will be paid on preference shares no distribution is being made on the ordinary shares.

The Distillers Company, Ltd., has declared an interim dividend on the ordinary stock of 1s. 3d. per £1 unit, equal to 6 1/2 per cent. (same), less tax, payable February 2. The usual half-year's dividend of 3 per cent. has also been declared on the 6 per cent. cumulative preference stock.

New Companies Registered

Elliott Engineering, Ltd. (371,246).—Private company. Capital, £2000 in 2000 shares of £1 each. Manufacturers of and dealers in chemicals, manures and dyestuffs, etc. Directors: J. W. J. Elliott; Mrs. R. M. Duckworth; Miss J. B. Duckworth; Mrs. K. E. Nicholson; Miss P. B. McAlpine. Solicitors: Birch, Collimore and Co., Friars, Chester.

J. Dampney and Company, Ltd. (371,135).—Private company. Capital, £100 in 100 shares of £1 each. Manufacturers of and dealers in paint, varnish, enamel, anti-fouling compositions, bituminous and protective paints, cellulose products, resin, chemicals, etc. Directors: J. W. Adamson; A. S. Wood. Registered office: Britannic Works, Portland Road, Newcastle-on-Tyne.

Wood Tar and Pitch Importers Association, Ltd. (371,141).—Company limited by guarantee, without share capital. To co-operate with the Ministry of Supply or other authority in the allocation and distribution in the U.K. of wood tar and pitch and other agreed products, to promote the interests of importers of such products, etc. The first members of the management committee are: H. H. Berlandina, O.B.E., M.C.; L. Danischewsky (chairman); A. Edwards; J. S. Hatfield; T. Martin. Solicitors: Woodroffes and Gibbs, 235 Westminster Bridge Road, S.E.1.

Chemical and Allied Stocks and Shares

SENTIMENT in Stock Exchange markets has moved closely in accordance with the nature of the war news from day to day, but security values have, on balance, shown partial recovery from the widespread reaction towards the end of last week. Markets were assisted by the steady undertone in British Funds and by the continued absence of heavy selling, although on the other hand, very little demand was in evidence. Shares of companies with important interests in the new war area, such as Burnah Oil and Dunlop Rubber, remained depressed. In fact, the tendency, so far as could be judged, was for attention to centre mainly on shares of companies identified with important war work or engaged exclusively in the home market. It is, of course, possible that, until the effects of the extension of the war can be more fully judged, some companies may decide to follow a rather more conservative dividend policy than might otherwise have been the case. Possibly the reduction in Turner and Newall's dividend from 15 to 12 1/2 per cent., which had been unexpected in the market, may arise partly from this, although the company has always dealt conservatively with its profits.

Imperial Chemical ordinary units were relatively steady, and are 32s. 1 1/2d. at the time of writing, compared with 32s. 6d. a

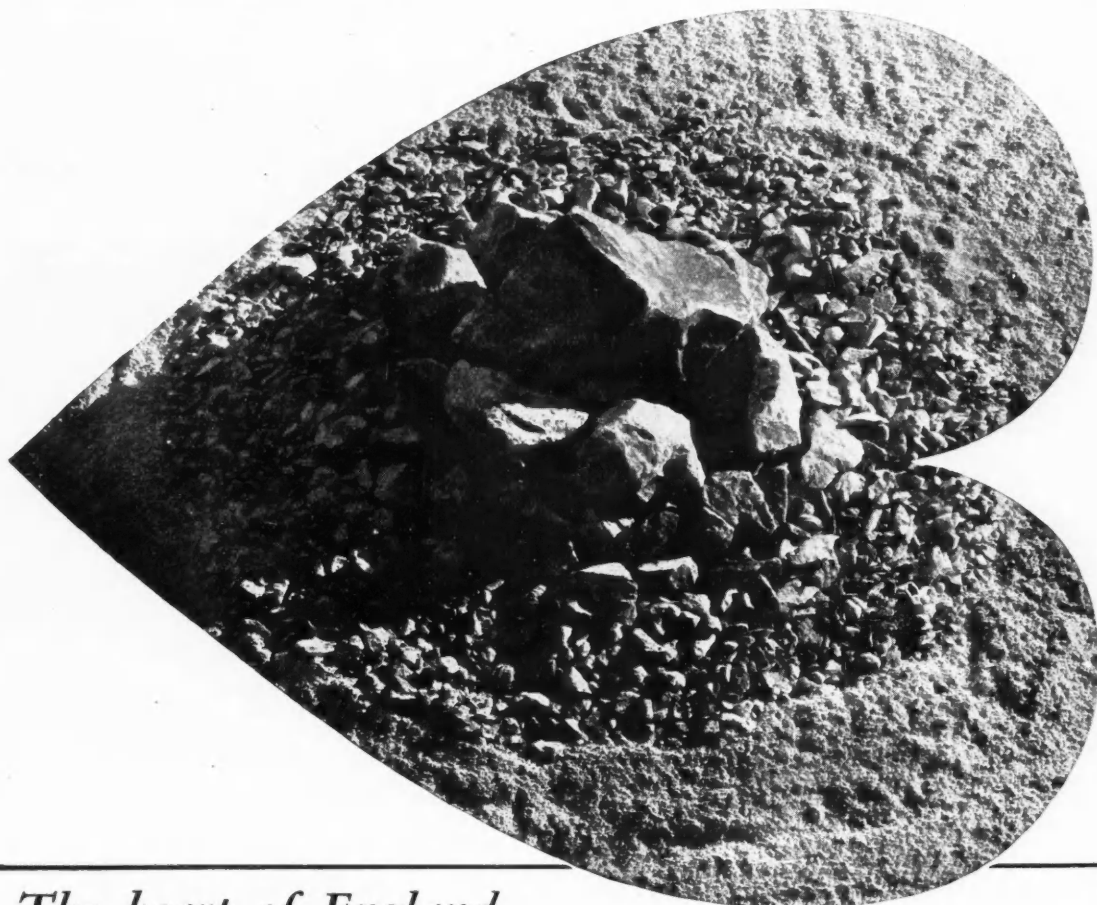
week ago. B. Laporte were inactive, but have remained at 63s. 9d., and elsewhere, Fison Packard at 36s. 9d. were virtually unchanged, aided by the maintenance of the dividend at 10 per cent. Under the influence of the "cut" in the dividend, Turner and Newall have been marked down from 73s. 6d. to 66s. 3d., but have a steadier appearance at the time of writing, awaiting publication of the full results. Pending the dividend announcement, Nairn and Greenwich moved back from 61s. 3d. to 58s. 9d., but there was very little selling, and as in many other directions, the reduced price was a reflection of the prevailing trend on the Stock Exchange. Lever and Unilever, however, were higher at 28s. 9d., compared with 28s. a week ago, assisted by the statement clarifying the position resulting from the declaration of full dividends on the three classes of preference shares of the Dutch company. Borax Consolidated deferred were again a steady feature, and at 30s. 3d. were, in fact, the same as a week ago. Moreover, United Molasses rallied after an earlier reaction, and at 29s. 7 1/2d. were virtually unchanged on balance, while elsewhere, the units of the Distillers Co. were little changed at 73s. Sentiment in regard to Dunlop Rubber was affected by the fact that the company has important interests in Malaya, and at the time of writing there has been a heavy decline to 31s. 3d. Imperial Smelting made the lower price of 11s. 6d., and in other directions, Barry and Staines moved back to 32s. 6d. On the other hand, Murex were a relatively steady feature at 88s. 9d., as were British Match at 34s. 3d. and British Aluminium at 15s. 6d.

There was very little selling in evidence among iron, steel and kindred securities. Stateley improved subsequently to 15s. and Dorman Long were 21s., awaiting the dividend announcement. Stewarts and Lloyds were 16s. 3d., and Tube Investments 86s. 9d. Elsewhere, Triplex Glass at 31s. 6d. have maintained the greater part of the good advance shown in recent weeks. There was again a fair amount of activity in British Plaster Board 5s. ordinary, which at 18s. 6d. were unchanged on balance. Movements in textile issues were moderate in character. Among other securities, Boots Drug were steady at 36s. 6d. and Sangers improved slightly to 18s. 9d., although elsewhere, Beecham's Pills deferred shares were easier at 10s. 3d. Greff-Chemicals Holdings 5s. ordinary remained around 5s. 9d., and Monsanto Chemicals 5 1/2 per cent. preference shares continued to be quoted at 22s. 6d. Among shares of companies associated with plastics, British Industrial Plastics 2s. ordinary were easier at 3s. 1 1/2d., but Erinoid 5s. ordinary were steady at 7s. 3d. Most oil shares reacted further, particularly Burnah Oil and Anglo-Iranian, which have been weak since the extension of the war. On the other hand, Trinidad Leaseholds at 67s. 6d. were again moderately better in price.

We have received the first number (dated August, 1941) of *Ion*, the monthly publication of the Sindicato Nacional de Industrias Químicas, the Spanish State Corporation of Chemical Industries. The principal article deals with the Nitrogen Industry in Spain, and is almost the last work of Dr. A. de G. Rocasolano, late Professor of Science at the University of Zaragoza, who died last April. Other general articles deal with the position of the chemical industry in the national economy and the present supply position of chemical products in Spain.

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Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Applications for Patents

Viscosimeters.—L. Bilmes. 10796.
Oxidation of carbon monoxide.—J. H. de Boer and J. van Ormendt. 10849.
Heat-treatment of multiple aluminium alloys.—T. F. Bradbury. 10676.
Manufacture of laminated sheet materials.—British Cellophane, Ltd., G. S. Heaven and C. R. Oswin. 10893.
Stabilisation of vinylidene chloride.—Distillers Co., Ltd., and E. G. Galitzstein. 10848.
Splitting-off of hydrogen halide from halogenated hydrocarbons.—Distillers Co., Ltd., M. Mugdan and D. H. R. Barton. 10684.
Production of cellulose derivatives.—H. Dreyfus. 10808.
Catalysts.—E. I. du Pont de Nemours and Co. (United States, Aug. 23, '40.) 10810.
Manufacture of surface-active materials.—E. I. du Pont de Nemours and Co. and J. H. Wernitz. 10910.
Nickel platinum alloy compositions.—A. E. Edwards. (United States, Aug. 26, '40.) 10721.
Iron oxide briquettes.—N. L. Evans and Imperial Chemical Industries, Ltd. 10914.
Manufacture of compounds of pyridine carboxylic acid amides.—J. R. Geigy A.G. (Switzerland, Aug. 24, '40.) 10791.
Production of coated textile material.—Hercules Powder Co. (United States, June 27.) 10830.
Apparatus for manufacture of charcoal.—G. E. Heyl. 10761.
Electrolysis.—B. W. Hirsh, and Imperial Chemical Industries, Ltd. 10912.
Electrolysis.—B. W. Hirsh, C. Carter and Imperial Chemical Industries, Ltd. 10913.
Production of vegetable albumen, etc.—A. Janser and C. S. Townsend. 10698.
Heating of thermoplastic, etc., materials.—W. J. Jarrard, W. R. Moritz, and H. P. Zade. 10658.

Machines for beating liquid glue into foam.—R. D. Marsh. 10738.
Organic halogen compounds.—J. R. Myles, W. J. Levy, and Imperial Chemical Industries, Ltd. 10915.
Treatment of hydrocarbons.—P. W. Reynolds, A. W. C. Taylor, J. G. M. Bremner, and Imperial Chemical Industries, Ltd. 10809.
Iodisation of textile fabrics.—C. R. H. Ritter. 10803.
Production of burnt dolomite.—S. A. pour l'Industrie de l'Aluminium. (Switzerland, Sept. 6, '40.) 10683.
Catalytic polymerisation of unsaturated hydrocarbons, etc. Standard Oil Development Co. (United States, Sept. 25, '40.) 10925.
Apparatus for producing articles from plastic substances.—J. J. Stanley, L. G. Stanley, and A. R. J. Stanley. 10704.
Processes for hydrolysing fats.—W. P. Williams (Procter and Gamble Co.). 10888.
Preparation of fibrous materials.—A. G. Zeller. 10824.
Fibrous sheet materials.—A. G. Zeller and P. A. Fere-mutsch. 10743.

Complete Specifications Open to Public Inspection

Production of per-acids.—British Celanese, Ltd. Feb. 21, 1940. 2371/41.
Manufacture of organic colouring materials.—E. I. du Pont de Nemours and Co. Feb. 23, 1940. 2473/41.
Manufacture and applications of surface active materials.—E. I. du Pont de Nemours and Co. Feb. 24, 1940. 2477/41.
Process for producing anhydrous magnesium sulphate.—American Zinc, Lead and Smelting Co. Feb. 23, 1940. 2507/41.

Complete Specifications Accepted

Production of water-soluble derivatives of iso-alkylol amides. J. Katz. Aug. 31, 1938. 538,825.
Preparation of d-tartaric acid.—C. Pfizer and Co. Dec. 13, 1938. 538,845.

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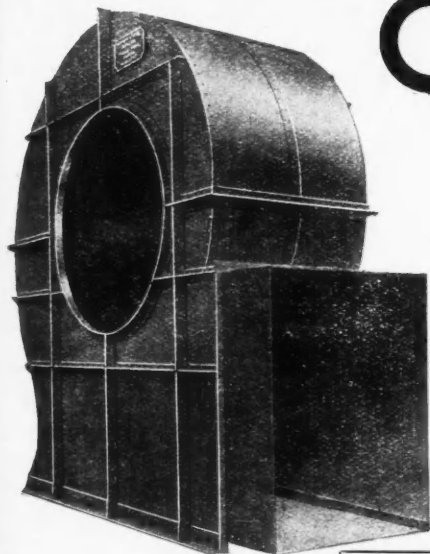
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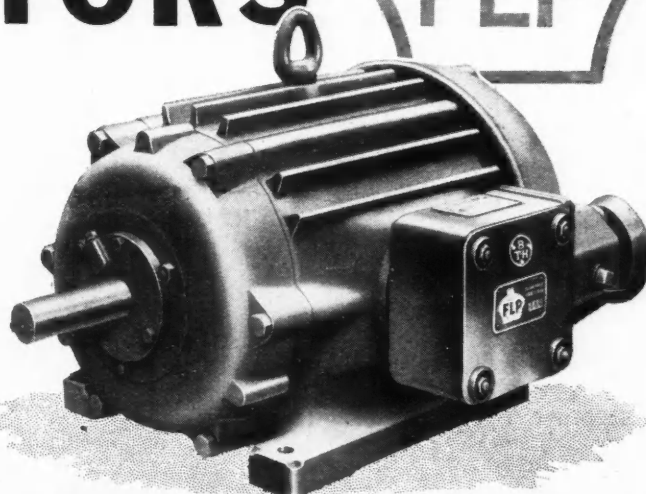


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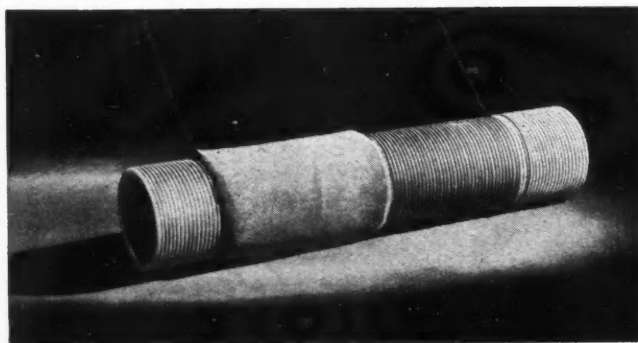
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Ash	0.01%
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The above analysis is based on the results, not of our own Control Laboratories alone, but also on the confirmatory Analytical Certificate issued by independent Consultants of international repute

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In effect, you can do a great deal to supply Britain with these extra vehicles practically overnight. Now is the time to plan and work to get a Quicker Turnround of the vehicles you use.

Ask yourselves these questions

- 1—Have you planned to make labour available to load or discharge immediately? Have you arranged to load to capacity?
- 2—Have you installed labour-saving equipment to speed up loading and unloading? If this is not possible, have you improvised?
- 3—Do you help consignees by informing them, as far as you can, when the goods you forward may be expected to arrive?
- 4—Are your arrangements between your office and your loading staff as good as they should be? For instance, have you arranged for the immediate checking of loads?
- 5—Have you talked the matter over with the men who actually load and unload?
- 6—Do you make the most of every hour of daylight to clear loads, carrying on into the black-out when possible?

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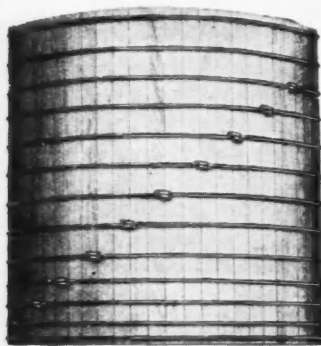
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A note on

VATS and the timber shortage

We still possess limited stocks of the usual imported timbers suitable for chemical Vats, but to save shipping space it is important that whenever possible home-grown timbers should be used instead. We have stocks of high quality English Oak and English Larch in seasoned condition and we hope that our customers will co-operate by considering the use of these timbers for their Vats wherever possible.



Further note—Since the war began we have so far fully maintained our pre-war high standards as to quality and seasoning of timber, and it is our intention to continue thus. If, however, circumstances should at any time compel otherwise, any quotation affected would contain an appropriate notification.

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